A Digitized Systematic Classification for Ecosystems with an Illustrated Summary of the Natural Vegetation of North America

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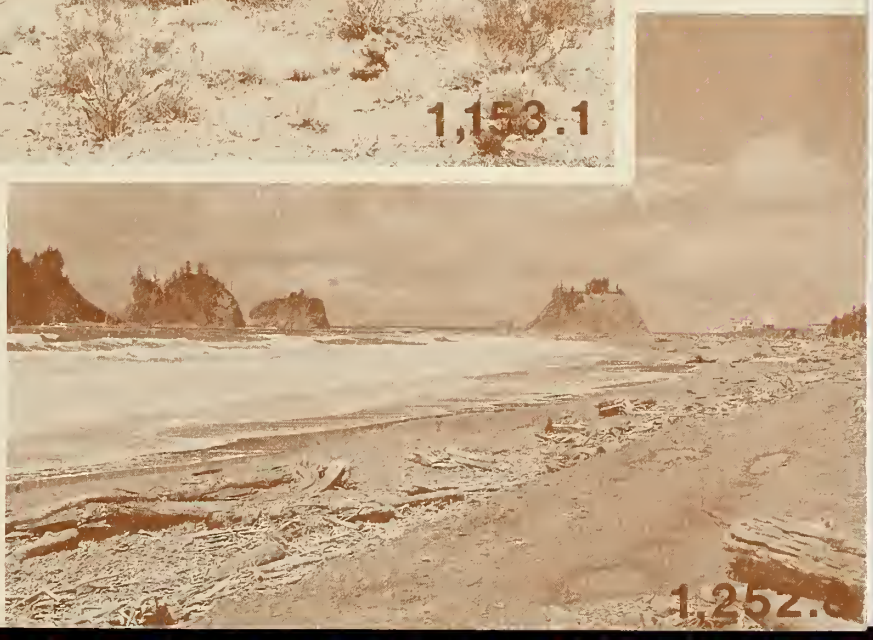

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Foreword

The classification system illustrated here is the product of field research conducted throughout the North American Southwest, literature synthesis, and modification through discussion with users and academicians over the past decade. A multiple-level and open-ended arrangement of hierarchical components in the system provides for unlimited information content, thereby insuring sensitivity to scale. The fourth level of the classification is the basis for the recent vegetation map of the southwestern United States and adjacent northwestern Mexico at scale 1:1,000,000 (Brown et al. 1977).

In April 1979, the agency leaders of the Bureau of Land Management, Fish and Wildlife Service, Forest Service, Geological Survey, and Soil Conservation Service endorsed a four-component classification system to be used for renewable resource inventories and assessments (Driscoll et al. 1978). The hierarchical components are vegetation, soil, landform, and aquatic (water). The vegetation system with some modification is that prepared by the United Nations Educational, Scientific, and Cultural Organization (1973). This modified system and the system presented here are generally comparable at the Community (Series) and Association levels, but differences do occur. These differences will be resolved in the future as more information is obtained and understood about plant community systems.

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INTRODUCTION

While the classification, analysis, and mapping of various biotic units has long been progressing in Europe, the Soviet Union, and the United States, recent efforts in the "developing" countries now indicate worldwide interest and activity in these fields (Aubreville 1958, Fittkau 1969, Flores et al. 1971, Whittaker 1973, Comision Tecnico Consultiva para la Determinacion Regional de los Coeficientes de Agostadero 1974). These endeavors have produced numerous resource classifications, particularly for vegetation. With some exceptions (Braun-Blanquet 1932, 1964; Daubenmire 1952, 1969; Gaussen 1953, 1955; Ellenberg and Mueller-Dombois 1967; Lactate 1969; Dasmann 1972; Pfister et al. 1977), classifications are based largely on limited criteria for potential vegetation (Kuchler 1964, 1967), or on partly artificial criteria such as land use per se (Anderson 1971, Anderson et al. 1972).

Again with some important exceptions (Dansereau 1957; Fosberg 1961; Krajina 1965; International Union for Conservation of Nature and Natural Resources 1973, 1974; United Nations Educational, Scientific, and Cultural Organization 1973; Ray 1975), resource classifications and classification schemes tend to be regional rather than continental and worldwide in their approach and applicability. Moreover, some recently developed wetland classification systems, while otherwise excellent, may be difficult to apply due to dependence on geologic and chemical criteria (Martin et al. 1953, Stewart and Kontrud 1971, Golet and Larson 1974, Cowardin et al. 1975, Zoltai et al. 1975).

Most classifications, moreover, are nonhierarchical or only partially hierarchical and, therefore, not readily subject to expansion and field modification (Wieslander 1935), Jensen 1947, Society of American Foresters 1954, Dansereau 1957, Garrison et al. 1974). This has resulted in resource management agencies combining and adapting various partial classification systems. The result is that no standardized system that is satisfactory is presently in effect within regions, much less throughout North America. In fact, there is as yet no agreement even on the basis for an evolutionarily derived system of classification. That the need exists is well known,[2] for example by the National Environmental Policy Act of 1969 and the National Resource Planning Act of 1974 (also see Layser 1974, Pfister 1975).

Although botanists and zoologists have long recognized and utilized the natural order of hierarchical systematics based on evolutionary criteria, resource managers have yet to agree on an analogous, taxonomic hierarchy for a natural universal classification system for the also evolutionarily derived ecosystems; their taxonomic division into plant association units comparable to species has been long recognized and discussed (Gleason 1939).

The ecological hierarchy herein ranks vegetative communities in systematized natural sets. This system is formulated on natural criteria and recognizes the limiting influences of moisture and temperature minima as well as the evolution of structure and composition of vegetation in general. The system was originally developed for southwestern North America where its adaptability has been well demonstrated (Lowe 1961; Brown and Lowe 1973, 1974a, 1974b). Incorporated are contributions of resource planners and users, plant geographers, zoogeographers, wildlife biologists and ecologists, all of which are in general usage today (Shelford and Shreve 1926; Halliday 1937; Gentry 1942; Shreve 1942; Dice 1943; Munz and Keck 1949, 1950; Oosting 1956; Curtis 1959; Shelford 1963; Lowe 1964; Braun 1967; Daubenmire and Daubenmire 1968; Franklin and Dyrness 1973; Mueller-Dombois and Ellenberg 1974). It is a natural world system.

A digitized system facilitates overall land use classification, resource planning, inventory and assessment, the interpretation of environmental uses and limitations, the delineation and stratification of habitats, and other activities of those concerned with natural resource inquiry. It has proven especially useful for environmental analysis where the inventory, assessment, and comparison of environmental systems is desired or required by governmental, educational, scientific, architectural, engineering, and other organizations. In short, the system is of particular use for those interested in and/or requiring classification of areas for resource management, study, acquisition, and/or preservation as "natural areas" throughout the world.

The digitization of hierarchy in the system makes it computer compatible, for example as a system or subsystem for storing and retrieving general information and data within or parallel to an overall management system. This system as applied to the North American Southwest is currently in use in the RUN WILD program

[2] *Driscoll, R. S., et al. 1976. MODIFIED ECOCLASS—A method for classifying ecosystems for the Rocky Mountain and Southwest Regions. U.S. Department of Agriculture, Forest Service, Rocky Mountain and Southwest Regions, and Rocky Mountain Forest and Range Experiment Station, ad hoc committee, mimeo, 117 p.*

being developed for field unit use on remote terminals by the Southwestern Region and the Rocky Mountain Forest and Range Experiment Station, USDA Forest Service (Patton 1978). This classification is similarly incorporated in the State of Arizona Resources Inventory System. It is also currently used by industry in environmental analysis procedures, for example as required by the National Environmental Policy Act.

Also, the use of a hierarchical sequence allows for flexibility in mapping of those complex communities where intensive levels of mapping would be impractical or needlessly time consuming. The hierarchical sequence allows for mapping at any scale.

An important advantage of a hierarchical system based on biotic criteria is the meaningful assignment of plant and animal habitats. This classification not only recognizes plant components within an assigned ecological distribution, it tells the reader which wildlife species could be expected to be present. As an example, the occurrence of nesting wood ducks (*Aix sponsa*) is expected in certain Temperate swampforests and riparian forests, as opposed to Tropical-Subtropical swampforests, expected in North America to be the nesting habitat of black-bellied whistling ducks (*Dendrocygna autumnalis*).

We present illustrated examples of the system at the second level (formation-type) to illustrate application on a world basis. Our fourth level (biome) illustrations and fifth level (series) examples for North America are representative and are presented to illustrate the reality, adaptability, and use of the classification system; they are not meant to be either a definitive or final classification. Examples of the use of the system to the sixth (association) level are given here for selected biomes within formation types (Rocky Mountain Montane Conifer Forest) and in previous publications relating to the North American Southwest (Lowe 1961; Brown and Lowe 1974a, 1974b) and North America (Brown et al. 1979).

A DIGITIZED HIERARCHY OF THE WORLD'S NATURAL ECOSYSTEMS

Where:

1,000 = Biogeographic (Continental) Realm
1,100 = Vegetation
1,110 = Formation-type
1,111 = Climatic (Thermal) Zone
1,111.1 = Regional Formation (Biome)
1,111.11 = Series (Community of generic dominants)
1,111.111 = Association (of specific dominants)
1,111.1111 = Composition-structure-phase

The number preceding the comma (e.g., 1,000) refers to the world's biogeographic realms (table 1). Origin and evolutionary history are recognized here as being of primary importance in the determination and classification of natural ecosystems. The mappable reality of the world's biogeographic realms is, of course, interpretive in part, for it is dependent on the criteria used. In those regions where the components of one realm merge gradually with those of another and the assignment of biogeographic origin is difficult, we include such transitional areas (wide ecotones) in both realms. The following seven realms are adapted from Wallace (1876), (see also Hesse et al. 1937, Darlington 1957, Dansereau 1957, Walter 1973, International Union for Conservation of Nature and Natural Resources 1974, DeLaubenfels 1975, Cox et al. 1976):

1000 Nearctic	Continental North America exclusive of the tropics and most highland areas south of the Tropic of Cancer. We include those tropic-subtropic regions in and adjacent to the North American Southwest and the Caribbean.
2000 Palaearctic	Eurasia exclusive of the tropics; Africa north of the Sahel.
3000 Neotropical and Antarctican	Continental South America, Central America, and most of Mexico south of the Tropic of Cancer. Antarctica.
4000 Oriental	Southeast Asia, the Indian subcontinent; the Phillipines, Indonesia, etc.
5000 Ethiopian	Africa south of the Sahara, Malagasy, and parts of the Arabian peninsula.
6000 Australian	Australia and Tasmania.
7000 Oceanic	Oceanic islands possessing a high degree of endemism.

FIRST LEVEL

The first digit after the comma (e.g., 1,100) refers to vegetation in one of four generalized types. Included are all plant communities that are presumed to be established naturally under existing climate and the cessation of artificially disruptive (human-caused) influences (table 1).

All existing and potential natural vegetation (PNV) is classified as belonging to uplands (1,100) or wetlands (1,200) as in table 1; or cultivated lands (1,300, 1,400). Only the first two are considered here. The important adaptation inherent in plants and animals of terrestrial (upland) as opposed to hydric (wetland) biotic communities is recognized by this dichotomy (Martin et al. 1953, Ray 1975). As discussed here, wetlands include those periodically, seasonally, or continually submerged biotic communities populated by species and/or life forms different from the immediately adjacent (upland) vegetation. Certain systems having both upland and wetland characteristics and components (e.g., riparian forests) could be properly considered as belonging to both divisions. They are included here in the wetlands division (1,200).

SECOND LEVEL

Second digit after the comma (1,1<u>1</u>0) refers to one of the following recognized ecological formations, which on a worldwide basis are the formation-types ("biome-types") (table 2). On continents, these are referred to as formations which are vegetative responses (functions) to integrated environmental factors, most importantly, available soil moisture.

Upland Formations

Tundra[3]	Communities existing in an environment so cold that moisture is unavailable during most of the year, precluding the establishment of trees, and in which the maximum development is that of perennial herbaceous plants, shrubs, lichens, and mosses, with grasses poorly represented or at least not dominant (fig. 1).
Forest and Woodland Communities	
Forest	Communities comprised principally of trees potentially over 15 m in height, and frequently characterized by closed and/or multilayered canopies (fig. 2).
Woodland	Communities dominated by trees with a mean potential height usually under 15 m, the canopy of which is usually open (sometimes very open)[4] or interrupted and singularly layered (fig. 3).
Scrubland	Communities dominated by sclerophyll or microphyll shrubs and/or multistemmed trees, generally not exceeding 10 m in height, usually presenting a closed physiognomy, or if open, interspaced with other perennial vegetation (fig. 4).
Grassland	Communities dominated actually or potentially by grasses and/or other herbaceous plants (fig. 5).
Desertland	Communities in an arid environment (usually less than 300 mm precipitation per annum) in which plants are separated by significant areas devoid of perennial vegetation (fig. 6).

Wetland Formations

Wet Tundra[5]	Aquatic communities existing in an environment so cold that available plant moisture is unavailable during most of the year, precluding the establishment of trees and all but a low herbaceous plant structure in a hydric matrix.
Swamp-Forest; Riparian Forest	Aquatic communities possessing an overstory of trees potentially over 10 m in height, and frequently characterized by closed and/or multilayered canopies (fig. 7).
Swamp-Scrub; Riparian Scrub	Aquatic communities dominated by short trees and/or woody shrubs, generally under 10 m in height and often presenting a closed physiognomy (fig. 8).
Marshland	Aquatic communities, in which the principal plant components are herbaceous emergents which normally have their basal portions annually, periodically, or continually submerged (fig. 9).
Strand	Beach and river channel communities subject to infrequent but periodic submersion, wind-driven waves or spray. Plants are separated by significant areas devoid of perennial vegetation (fig. 10).
Submergents	Aquatic communities comprised entirely or almost entirely of plants mostly submerged or lacking emergent structures (fig. 11).

Some upland and wetland areas (e.g., dunes, lava flows, playas, sinks, etc.) are essentially without vegetation or are sparingly populated by simple organisms. For purposes of classification, these areas could be considered as belonging to a nonvascular formation-type (table 2).

[3]*The holistic integrity of a "tundra" formation is not without serious question. Treated here, tundra may also be composed of grasslands, scrublands, marshlands (wet tundra), and desertlands in an Arctic—Boreal Climatic Zone (table 4) (Billings and Mooney 1968, Billings 1973).*

[4]*The "savanna" formation (Dyksterhuis 1957) is here recognized as an ecotone between woodland and grassland. Those homogeneous areas in which the crowns of trees normally cover less than approximately 15% of the ground space are classified as grasslands where grasses are actually or potentially dominant (=savanna-grassland). Mosaics of grasslands and smaller or larger stands of trees and shrubs are "parklands" and are composed of two or more ecologically distinct plant formations (Walter 1973).*

[5]*The holistic integrity of a "tundra" formation is not without serious question. Treated here, tundra may also be composed of grasslands, scrublands, marshlands (wet tundra), and desertlands in an Arctic—Boreal Climatic Zone (table 5) (Billings and Mooney 1968, Billings 1973).*

THIRD LEVEL

Third digit beyond the comma (e.g., 1,11<u>1</u>) refers to one of the four world climatic zones (Walter 1973, Ray 1975, Cox et al. 1976) in which minimum temperature remains a major evolutionary control of and within the zonation and formation-types (table 3).

Arctic—Boreal (Antarctic—Austrial)	Characterized by lengthy periods of freezing temperatures, with the coldest month isotherm -3° C (Koppen 1931), growing season of short duration (generally less than 100 days), occasionally interrupted by nights of below-freezing temperatures.
Cold Temperate	Freezing temperatures of short duration, although of frequent occurrence, during winter months. Potential growing season generally of from 100 to 200 days and confined to spring and summer when freezing temperatures are infrequent or absent.
Warm Temperate	Freezing temperatures of short duration but generally occurring every year during winter months. Potential growing season over 200 days with an average of less than 125-150 days being subject to temperatures lower than 0° C or chilling fogs.
Tropical-Subtropical	Infrequent or no 24-hour periods of freezing temperatures, chilling fogs, or wind.

FOURTH LEVEL

Fourth level (e.g., 1,111.<u>1</u>) refers to a subcontinental unit that is a major biotic community (= biome). These biomes are characterized by a distinctive evolutionary history—within a formation—and are centered in, but not necessarily restricted to, a biogeographic region or province possessing a particular precipitation pattern or other climatic regime (Pitelka 1941, Dice 1943, Odum 1945, Franklin 1977) (fig. 12). It is this and the fifth levels that have provided the most successful and useful mapping of states, provinces, and continents (Shantz and Zon 1924, Bruner 1931, Shreve 1951, Kuchler 1964, Franklin and Dyrness 1973, Brown 1973, Brown et al. 1977).

Biogeographic provinces and biomes are also the bases for the biosphere reserve program in the United States and elsewhere (International Union for Conservation of Nature and Natural Resources 1974, Franklin 1977). A partial summary of the biotic communities for Nearctic and adjacent Neotropical America is given in tables 4 and 5.

FIFTH LEVEL

Fifth level (e.g., 1,111.1<u>1</u>) provides the principal plant-animal communities within the biomes, recognized and distinguished primarily on distinctive climax plant dominants (= series). These series, sometimes referred to as cover-types (Society of American Foresters 1954), are each composed of one or more biotic associations characterized by shared climax dominants within the same formation, zone, and biome (Oosting 1956, Lowe 1964, Franklin and Dyrness 1973, Pfister et al. 1977). For example, a ponderosa pine series would include those Rocky Mountain forest associations in which *Pinus ponderosa* was a dominant component (table 4). The diversity of tropical and subtropical climax dominants is often inherently more complex than in boreal and temperate communities.

It should be pointed out that some plants are highly faculative and the same species may be a dominant in more than one formation-type. As an extreme example, mesquite (*Prosopis juliflora*) may be the dominant life-form in certain woodland, scrubland, desertland, and even forest and disclimax grassland formations. The distribution of some plant dominants also span more than one climatic zone (e.g., mesquite, creosote (*Larrea tridentata*), and the introduced *Tamarix*). The plant and animal associates of these dominants usually differ when passing from one formation-type or climatic zone to another, however. Numerous generic dominants and some species are shared also by more than one biome (e.g., *Populus*, *Salix*, *Pinus*, *Quercus*, and *Larrea*). Closer investigation usually reveals that biomes do not normally share the same speciation within genera, and those that do may exhibit major genetic differences between biomes (Yang and Lowe 1970). For these reasons, the determination of fifth and sixth level communities will require interpretive revision and modification of the classification as field investigations accumulate.

SIXTH LEVEL

Sixth level (e.g., 1,111.11<u>1</u>) refers to distinctive plant associations (and associes)[6] based on the occurrence of particular dominant species more or less local (or regional) in distribution and generally equivalent to habit-types as outlined by Daubenmire and Daubenmire (1968), Layser (1974), and Pfister et al. (1977). While we demonstrate examples for certain communities within selected biomes (e.g., the Douglas-fir and Pine Series within the Rocky Mountain Montane Conifer Forest), the enormous numbers of sets preclude presentation here for the continental treatments in tables 4 and 5. These may be added at length for regional studies. Those communities judged to be seral or successional in nature may be preceded by an "s" at the seventh level.

[6] *Includes associations (and successional associes) constituted by single species that are more precisely termed consociations (and successional consocies) (Weaver and Clements 1938).*

SEVENTH LEVEL

Seventh level (e.g., 1,111.1111) accommodates detailed measurement and assessment of quantitative structure, composition, density and other numerical determinations for dominants, understories, and other species. Implementation of this level in the system is designed for particular intensive studies for limited areas (Dick-Peddie and Moir 1979).

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TABLES

Table 1.—Summary for the natural vegetation of the world to the first level

Biogeographic realm	1. Upland vegetation	2. Wetland vegetation
1,000 Nearctic	1,100	1,200
2,000 Palaearctic	2,100	2,200
3,000 Neotropical—Antarctican	3,100	3,200
4,000 Oriental	4,100	4,200
5,000 Ethiopian	5,100	5,200
6,000 Australian	6,100	6,200
7,000 Oceanic	7,100	7,200

Table 2.—Summary for the natural upland and wetland vegetation of the world to the second level (formation-type)

Biogeographic realm	Formation-type					
	1. Tundra	2. Forest and Woodland	3. Scrub-land	4. Grassland	5. Desertland	6. Non-vascular
UPLAND						
1,000 Nearctic	1,110	1,120	1,130	1,140	1,150	1,160
2,000 Palaearctic	2,110	2,120	2,130	2,140	2,150	2,160
3,000 Neotropical—Antarctican	3,110	3,120	3,130	3,140	3,150	3,160
4,000 Oriental	4,110	4,120	4,130	4,140	4,150	4,160
5,000 Ethiopian	5,110	5,120	5,130	5,140	5,150	5,160
6,000 Australian	6,110	6,120	6,130	6,140	6,150	6,160
7,000 Oceanic	7,110	7,120	7,130	7,140	7,150	7,160
	1. Wet tundra	**2. Forest***	**3. Swamp-Scrub**	**4. Marshland**	**5. Strand**	**6. Submergent**
WETLAND						
1,000 Nearctic	1,210	1,220	1,230	1,240	1,250	1,260
2,000 Palaearctic	2,210	2,220	2,230	2,240	2,250	2,260
3,000 Neotropical—Antarctican	3,210	3,220	3,230	3,240	3,250	3,260
4,000 Oriental	4,210	4,220	4,230	4,240	4,250	4,260
5,000 Ethiopian	5,210	5,220	5,230	5,240	5,250	5,260
6,000 Australian	6,210	6,220	6,230	6,240	6,250	6,260
7,000 Oceanic	7,210	7,220	7,230	7,240	7,250	7,260

Swamp-forests, bog forests, and riparian forests.

Table 3.—Summary for the natural upland and wetland vegetation of Nearctic and adjacent Neotropical North America to the third level

Formation	Climatic (thermal) zone			
	1. Arctic—Boreal	2. Cold Temperate	3. Warm Temperate	4. Tropical—Subtropical
UPLAND				
1,110 Tundra	1,111			
1,120 Forests and Woodland	1,121	1,122	1,123	1,124
1,130 Scrubland	1,131	1,132	1,133	1,134
1,140 Grassland	1,141	1,142	1,143	1,144
1,150 Desertland	1,151	1,152	1,153	1,154
1,160 Nonvegetated	1,161	1,162	1,163	1,164
WETLAND				
1,210 Wet Tundra	1,211			
1,220 Forest*	1,221	1,222	1,223	1,224
1,230 Swamp-Scrub	1,231	1,232	1,233	1,234
1,240 Marshland	1,241	1,242	1,243	1,244
1,250 Strand	1,251	1,252	1,253	1,254
1,260 Submergent	1,261	1,262	1,263	1,264

Swamp-forests, bog forests, and riparian forests.

Table 4.—Nomenclature of upland biotic communities (fourth level) of Nearctic and adjacent Neotropical North America with some community (series) and association level examples

1,100 Nearctic Upland Vegetation
1,110 Tundra Formation
1,111 Arctic Tundras
1,111.1 Polar (High Arctic) Tundra
1,111.11 Sedge—Moss (Meadow) Series*
1,111.12 Cushion Plant—Lichen Series*
1,111.2 Alaskan (Low Arctic) Coastal Tundra (fig. 13)
1,111.21 Sedge—Grass—Moss Series*
1,111.22 Heath—Avens Series*
1,111.3 Canadian (Barren Ground = Low Arctic) Tundra
1,111.31 Heath—Lichen Series*
1,111.4 Arctic Alpine Tundra
1,111.41 Heath—Lichen Series*
1,111.5 Rocky Mountain Alpine Tundra*** (fig. 14)
1,111.51 Lichen—Moss Series*
1,111.52 Mixed Herb Series*
1,111.53 Avens—Sedge Series*
1,111.54 Woodrush Series*
1,111.6 Sierran—Cascade Alpine Tundra
1,111.61 Lichen—Moss Series*
1,111.62 Mixed Herb Series*
1,111.7 Adirondack—Appalachian Alpine Tundra
1,111.71** Lichen—Moss Series*

120 Forest and Woodland Formation
121 Boreal Forests and Woodlands
121.1 Canadian Subarctic Conifer Forest and Woodland (North American Taiga) (figs. 15 and 16)
121.11 White Spruce—Balsam Fir Series*
121.12 Black Spruce Series*
121.2 Appalachian Subalpine Conifer Forest (fig. 17)
121.21 Red Spruce—Balsam Fir Series*
121.3 Rocky Mountain Subalpine Conifer Forest and Woodland***
121.31 Engelmann Spruce—Alpine Fir Series* (fig. 18)
121.32 Bristlecone Pine—Limber Pine Series* (fig. 19)
121.4 Sierran—Cascade Subalpine Conifer Forest (fig. 20)
121.41 Limber Pine—Lodgepole Pine Series*
121.42 Whitebark Pine Series*
121.43 Mountain Hemlock Series*
121.5 Madrean Subalpine Conifer Forest
121.51 Pine—Religious Fir Series*

122 Cold Temperate Forests and Woodlands
122.1 Northeastern Deciduous Forest (fig. 21)
122.11 Oak—Hickory Series*
122.12 Oak—Chestnut Series*
122.13 Beech—Maple Series*
122.14 Oak—Pine Series*
122.15 Maple—Basswood Series*
122.16 Hemlock—White Pine—Hardwood Series*
122.2 Pacific Coastal (Oregonian) Conifer Forest (figs. 22 and 23)
122.21 Coast Redwood Series*
122.22 Douglas-fir Series*
122.23 Western Hemlock Series*
122.24 Sitka Spruce Series*
122.25 Grand Fir Series*
122.3 Rocky Mountain (= Petran) Montane Conifer Forest (fig. 24)
122.31 Douglas-fir—White fir (= Mixed Conifer) Series*
122.311 *Pseudotsuga menziesii* Association*
122.312 *Pseudotsuga menziesii—Abies concolor* Association*
122.313 *Pseudotsuga menziesii*—Mixed Conifer (*Abies concolor, Pinus flexilis, Acer glabrum, Populus tremuloides, Pinus ponderosa*) Association*
122.314 *Populus tremuloides* subclimax Association*
122.32 Pine Series*
122.321 *Pinus ponderosa* Association*
122.322 *Pinus ponderosa*—Mixed Conifer Association*
122.323 *Pinus ponderosa—Quercus gambelii* Association*
122.324 *Pinus ponderosa—Quercus arizonica* Association*
122.325 *Pinus ponderosa—Juniperus deppeana* Association*
122.326 *Populus tremuloides* subclimax Association*
122.327 *Pinus flexilis* Association*
122.328 *Pinus ponderosa—Abies concolor* Association*
122.33 Gambel Oak Series*
122.331 *Quercus gambelii* Association*
122.4 Great Basin Conifer Woodland (fig. 25)
122.41 Pinyon—Juniper Series*
122.5 Sierran—Cascade Montane Conifer Forest (fig. 26)
122.51 Mixed Conifer Series*
122.52 Red Fir Series*
122.53 Pacific Silver Fir Series*
122.54 White Fir Series*
122.55 Pine Series*
122.56 Black Oak Series*
122.6 Madrean Montane Conifer Forest
122.61 Douglas-fir—Mixed Conifer Series*
122.62 Pine Series*

123 Warm Temperate Forests and Woodlands
123.1 Southeastern Mixed Deciduous and Evergreen Forest (figs. 27 and 28)
123.11 Pine Series*
123.12 Mixed Mesophytic Series*
123.13 Mixed Hardwood Hammock Series*
123.2 Californian Mixed Evergreen Forest (fig. 29)
123.21 Mixed Mesophytic Series*
123.22 Big-cone Spruce Series*
123.3 Californian Evergreen Woodland (fig. 30)
123.31 Encinal (Oak) Series*
123.32 Walnut Series*
123.33 Oak—Pine Series*
123.4 Madrean Evergreen Forest and Woodland (fig. 31)
123.41 Encinal (Oak) Series*
123.42 Oak—Pine Series*
123.5 Relict Conifer Forest and Woodland (figs. 32 and 33)
123.51 Closed-cone Pine Series*
123.52 Cypress Series*

124 Tropical—Subtropical Forests and Woodlands
124.1 Caribbean Montane Rain Forest (fig. 34)
124.11 Palm Series*
124.12 Tabenuco—Palocolorado Series*
124.2 Caribbean Cloud Forest
124.21 Ocotea—Roble de Sierra Series*
124.3 Caribbean Evergreen Forest (figs. 35 and 36)
124.31 Pine Series*
124.32 Tabebuia—Gallo Series*
124.4 Caribbean Deciduous Forest
124.41 Mixed Short Tree Series*
124.5 Tamaulipan Semideciduous Forest (fig. 37)
124.51 Mixed Short Tree Series*
124.6 Sinaloan Deciduous Forest (fig. 38)
124.61 Mixed Short Tree Series*

130 Scrubland Formation
131 Arctic—Boreal Scrublands
131.1 Alaskan (Low Arctic) Coastal Scrub (fig. 39)
131.11 Crowberry Series*
131.12 Birch—Willow Series*

*Examples only.
**The first "1" (in front of comma and representing the Nearctic realm) is understood and dropped for tabular convenience only from this point onward.
***Further consideration may warrant separation of this biotic community into Rocky Mountain and Great Basin units.

Table 4.—Continued

131.2 Canadian (Low Arctic, Barren Ground) Subpolar Scrub
131.21 Birch—Willow Series*
131.22 Alder Series*
131.3 Alaskan Alpine and Subalpine Scrub (fig. 40)
131.31 Willow—Birch Series*
131.4 Adirondack—Appalachian Alpine and Subalpine Scrub
131.41 Hobblebush Series*
131.5 Rocky Mountain Alpine and Subalpine Scrub (fig. 41)
131.51 Willow Series*
131.52 Spruce Elfinwood Series*
131.53 Bristlecone Pine Elfinwood Series*
131.6 Sierran—Cascade Alpine and Subalpine Scrub
131.61 Limber Pine—Lodgepole Pine Elfinwood Series*
131.62 Whitebark Pine Elfinwood Series*

132 Cold Temperate Scrublands
132.1 Great Basin Montane Scrub (fig. 42)
132.11 Oak—Scrub Series*
132.12 Mountainmahogany Series*
132.13 Maple—Scrub Series*
132.14 Serviceberry Series*
132.15 Bitterbush Series*
132.16 Mixed Deciduous Series*
132.2 Sierran—Cascade Montane Scrub
132.21 Manzanita Series*
132.22 Mixed Scrub Series*
132.3 Plains Deciduous Scrub (fig. 43)
132.31 Oak—Scrub Series*
132.32 Sumac Series*
132.33 Mixed Deciduous Series*

133 Warm Temperate Scrublands
133.1 Californian Chaparral (fig. 44)
133.11 Chamise Series*
133.12 Scrub Oak Series*
133.13 Manzanita Series*
133.14 Ceanothus Series*
133.15 Mixed Evergreen Sclerophyll Series*
133.2 Californian Coastal Scrub (fig. 45)
133.21 Sage Series*
133.22 Mixed Shrub Series*
133.3 Interior Chaparral (fig. 46)
133.31 Scrub Oak Series*
133.32 Manzanita Series*
133.33 Ceanothus Series*
133.34 Mountainmahogany Series*
133.35 Silktassel Series*
133.36 Mixed Evergreen Sclerophyll Series*
133.4 Southeastern Maritime Scrub
133.41 Scrub Oak Series*

134 Tropical—Subtropical Scrublands
134.1 Caribbean Thorn Scrub
134.11 Mixed Deciduous Series*
134.2 Tamaulipan Thorn Scrub (fig. 47)
134.21 Mixed Deciduous Series*
134.3 Sinaloan Thorn Scrub (fig. 48)
134.31 Mixed Deciduous Series*
134.32 Mesquite Disclimax Series*

140 Grassland Formation
141 Arctic—Boreal Grasslands
141.1 Alaskan (Low Arctic) Coastal Grassland (fig. 49)
141.11 Cottongrass Series*
141.2 Canadian (Low Arctic) Grassland
141.21 Bunchgrass Series*
141.3 Appalachian Subalpine (Balds) Grassland (fig. 50)
141.31 Oatgrass—Herb Series*
141.4 Rocky Mountain Alpine and Subalpine Grassland (fig. 51)
141.41 Bunchgrass Series*
141.42 Sedge—Forb—Grass Series*
141.5 Sierran—Cascade Alpine and Subalpine Grassland
141.51 Bunchgrass Series*
141.52 Sedge—Forb—Grass Series*
141.6 Madrean Alpine and Subalpine Grassland
141.61 Bunchgrass Series*

142 Cold Temperate Grasslands
142.1 Plains Grassland
142.11 Bluestem "tall-grass" Series* (fig. 52)
142.12 Grama Series* (fig. 53)
142.13 Buffalo-grass Series*
142.14 Mixed "short-grass" Series*
142.15 Shrub—Grass Disclimax Series*
142.2 Great Basin Shrub—Grassland
142.21 Wheatgrass Series*
142.22 Mixed Bunchgrass Series* (fig. 54)
142.23 Ricegrass Series*
142.24 Sacaton Series*
142.25 Cheatgrass Disclimax Series*
142.3 Pacific Coastal (Oregonian) Grassland
142.31 Mixed Bunchgrass Series*
142.4 Rocky Mountain Montane Grassland (fig. 55)
142.41 Mixed Meadow Series*
142.42 Rush Series*
142.43 Fern Series*
142.44 Iris Disclimax Series*
142.5 Sierran—Cascade Montane Grassland
142.51 Mixed Meadow Series*
142.52 Rush Series*

143 Warm Temperate Grasslands
143.1 Scrub—Grassland (Semidesert Grassland) (fig. 56)
143.11 Grama Grass—Scrub Series*
143.12 Tobosa Grass—Scrub Series*
143.13 Curley-mesquite Scrub Series*
143.14 Sacaton—Scrub Series*
143.15 Mixed Grass—Scrub Series*
143.16 Shrub—Scrub Disclimax Series*
143.2 Californian Valley Grassland (fig. 57)
143.21 Annual Disclimax Series*

144 Tropical—Subtropical Grasslands
144.1 Caribbean Savanna Grassland (fig. 58)
144.2 Gulf Coastal (Tamaulipan) Grassland (fig. 59)
144.21 Beardgrass Series*
144.3 Sonoran Savanna Grassland (fig. 60)
144.31 Mixed Perennial Grass Series*
144.32 Grama Series*
144.33 Three-awn Series*

150 Desertland Formation
151 Arctic—Boreal Desertlands
151.1 Polar Desert-Scrub (fig. 61)
151.11 Moss—Lichen Series*

152 Cold Temperate Desertlands
152.1 Great Basin Desertscrub (fig. 62)
152.11 Sagebrush Series*
152.12 Shadscale Series*
152.13 Blackbrush Series*
152.14 Rabbitbrush Series*
152.15 Winterfat Series*
152.16 Mixed Scrub Series*
152.17 Saltbush Series*
153 Warm Temperate Desertlands
153.1 Mohave Desert-Scrub (fig. 63)
153.11 Creosotebush Series*
153.12 Blackbrush Series*
153.13 Mesquite Series*
153.14 Bladdersage Series*
153.15 Joshuatree Series*
153.16 Catclaw Series*
153.17 Saltbush Series*

Table 4.—Continued

153.2 Chihuahuan Desert-Scrub (fig. 64)
153.21 Creosotebush—Tarbush Series*
153.22 Whitethorn Series*
153.23 Sandpaperbush Series*
153.24 Mesquite Series*
153.25 Succulent Series*
153.26 Mixed Scrub Series*
153.27 Saltbush Series*

154 Tropical—Subtropical Desertlands
154.1 Sonoran Desert-Scrub (fig. 65)
154.11 Creosotebush—Bursage ("Lower Colorado Valley" et al.) Series*
154.12 Paloverde—Mixed Cacti ("Arizona Upland") Series*
154.13 Brittlebush—Ironwood ("Plains of Sonora") Series*
154.14 Copal—Torote ("Central Gulf Coast") Series*
154.15 Agave—Bursage ("Vizcaino") Series*
154.16 Paloblanco—Agria ("Magdalena") Series*
154.17 Saltbush Series*

Table 5.—Nomenclature of wetland biotic communities (fourth level) of Nearctic and adjacent Neotropical North America with some community (series) and association level examples for the North American Southwest

1,200 Nearctic Wetland Vegetation
1,210 Wet Tundra Formation
1,211 Arctic Wet Tundras
1,211.1 Polar (High Arctic) Wet Tundra
1,211.11 Sedge—Moss Series*
1,211.12 Rush Series*
1,211.2 Greenlandian Wet Tundra
1,211 21 Sedge—Moss Series*
1,211.3 Alaskan (Coastal) Wet Tundra (fig. 66)
1,211 31 Sedge—Moss Series*
1,211.4 Canadian (Low Arctic) Wet Tundra
1,211.41 Sedge—Grass—Moss Series*
1,211 42** Rush Series*

220 Forest Formation
221 Boreal Swamp and Riparian Forests
221 1 Canadian Swamp Forest (fig. 67)
221.11 Black Spruce—Tamarack Series*
221.12 Willow—Alder Series*

222 Cold Temperate Swamp and Riparian Forests
222.1 Northeastern Bog, Swamp, and Riparian Forests (fig. 68)
222.11 White Cedar Series*
222.12 Cottonwood—Willow Series*
222.13 Ash—Maple Series*
222.2 Plains and Great Basin Riparian Deciduous Forest
222.21 Cottonwood—Willow Series*
222.3 Rocky Mountain Riparian Deciduous Forest
222.31 Cottonwood—Willow Series*
222.32 Mixed Broadleaf Series*
222.4 Sierran—Cascade Riparian Deciduous Forest
222.41 Cottonwood—Willow Series*
222.42 Mixed Broadleaf Series*
222.5 Pacific Coastal (Oregonian) Riparian Deciduous Forest
222.51 Cottonwood—Willow Series*

223 Warm Temperate Swamp and Riparian Forests
223.1 Southeastern Swamp and Riparian Forest (fig. 69)
223.11 Tupelo—Cypress Series*
223.12 Southern White Cedar Series*
223.13 Mixed Hardwood (Bottomland) Series*
223.14 Cottonwood—Willow Series*
223.2 Southwestern Riparian Deciduous Forest and Woodland (fig. 70)
223.21 Cottonwood—Willow Series*
223.22 Mixed Broadleaf Series*
223.3 Californian Riparian Deciduous Forest and Woodland
223.31 Cottonwood—Willow Series*
223.32 Mixed Broadleaf Series*

224 Tropical—Subtropical Swamp, Riparian, and Oasis Forests
224.1 Caribbean Interior Swamp and Riparian Forests
224.11 Mixed Evergreen Series*
224.12 Palm Series*
224.2 Caribbean Maritime Swamp-Forest (fig. 71)
224.21 Mangrove Series*
224.3 Tamaulipan Interior Swamp and Riparian Forests
224.31 Mixed Evergreen Series*
224.32 Palm Series*
224.4 Sinaloan Interior Swamp and Riparian Forests (fig. 72)
224.41 Mixed Evergreen Series*
224.42 Palm Series*
224.5 Sonoran Riparian and Oasis Forests
224.51 Palm Series* (fig. 73)
224.52 Mesquite Series* (fig. 74)
224.53 Cottonwood—Willow Series*

230 Swamp-Scrub Formation
231 Arctic—Boreal Swamp-Scrubs
231.1 Polar (High Arctic) Swamp-Scrub
231.11 Willow Series*
231.2 Greenlandian Swamp-Scrub
231.21 Willow Series*
231.3 Alaskan Swamp-Scrub
231.31 Willow Series*
231.4 Canadian Swamp-Scrub (fig. 75)
231.41 Willow Series*
231.42 Leatherleaf Series*
231.5 Adirondack—Appalachian Alpine and Subalpine Swamp and Riparian Scrub
231.51 Willow Series*
231.6 Rocky Mountain Alpine and Subalpine Swamp and Riparian Scrub (fig. 76)
231.61 Willow Series*
231.7 Sierran—Cascade Alpine and Subalpine Swamp and Riparian Scrub
231.71 Willow Series*

232 Cold Temperate Swamp and Riparian Scrubs
232.1 Northeastern Deciduous Swamp-Scrub
232.11 Willow Series*
232.12 Sweet Gale Series*
232.13 Buttonbush Series*
232.14 Cranberry Series*
232.15 Mixed Narrowleaf Series*
232.2 Plains and Great Basin Riparian Scrub (fig. 77)
232.21 Willow Series*
232.22 Saltcedar Disclimax Series*
232.3 Rocky Mountain Riparian Scrub (fig. 78)
232.31 Willow—Dogwood Series*
232.4 Sierran—Cascade Riparian Scrub
232.41 Willow Series*
232.5 Pacific Coastal (Oregonian) Swamp and Riparian Scrub
232.51 Willow Series*
232.52 Mixed Narrowleaf Series*

*One or more examples only are given for the fifth level.
**The first "1" (in front of comma and representing the Nearctic realm) is understood and dropped for tabular convenience only from this point onward.

Table 5.—Continued

233 Warm Temperate Riparian and Swamp Scrubs
- 233.1 Southeastern Mixed Deciduous and Evergreen Swamp Scrub
  - 233.11 Mixed Broadleaf Series*
- 233.2 Interior Southwestern Swamp and Riparian Scrub (fig. 79)
  - 233.21 Seepwillow Series*
  - 233.22 Saltcedar Disclimax Series*
- 233.3 Californian Deciduous Swamp and Riparian Scrub
  - 233.31 Mixed Narrowleaf Series*

234 Tropical—Subtropical Swamp and Riparian Scrub
- 234.1 Cribbean Interior Swamp Scrub
  - 234.11 Mixed Evergreen Series*
- 234.2 Caribbean Maritime Swamp-Scrub
  - 234.21 Mangrove Series*
- 234.3 Tamaulipan Interior Swamp and Riparian Scrub
  - 234.31 Mixed Evergreen Series*
- 234.4 Tamaulipan Maritime Swamp-Scrub
  - 234.41 Mangrove Series*
- 234.5 Sinaloan Interior Swamp and Riparian Scrub
  - 234.51 Mixed Evergreen Series*
- 234.6 Sinaloan Maritime Swamp-Scrub (fig. 80)
  - 234.61 Mangrove Series*
- 234.7 Sonoran Deciduous Swamp and Riparian Scrub (fig. 81)
  - 234.71 Mixed Scrub Series*
  - 234.72 Saltcedar Disclimax Series*

240 Marshland Formation

241 Arctic—Boreal Marshlands
- 241.1 Polar (High Arctic) Marshland
  - 241.11 Sedge Series*
  - 241.12 Rush Series*
- 241.2 Greenlandian Marshland
  - 241.21 Sedge Series*
  - 241.22 Rush Series*
- 241.3 Alaskan Maritime (Coastal) Marshland
  - 241.31 Sedge Series*
  - 241.32 Rush Series*
- 241.4 Canadian Interior Marshland (fig. 82)
  - 241.41 Sedge Series*
  - 241.42 Rush Series*
- 241.5 Canadian Maritime (Coastal) Marshland
  - 241.51 Sedge Series*
- 241.6 Adirondack—Appalachian Alpine and Subalpine Marshland
  - 241.61 Sedge Series*
  - 241.62 Rush Series*
- 241.7 Rocky Mountain Alpine and Subalpine Marshland
  - 241.71 Rush Series*
  - 241.72 Manna Grass Series*
- 241.8 Sierran—Cascade Alpine and Subalpine Marshland
  - 241.81 Rush Series*

242 Cold Temperate Marshlands
- 242.1 Northeastern Interior Marshland
  - 242.11 Sedge Series*
  - 242.12 Rush Series*
  - 242.13 Bur-reed Series*
  - 242.14 Cattail Series*
  - 242.15 Bulrush Series*
  - 242.16 Arrow-arum Series*
  - 242.17 Water Lily Series*
  - 242.18 Reed Canarygrass Series*
- 242.2 Northeastern Maritime (Coastal) Marshland
  - 242.21 Saltgrass Series*
- 242.3 Plains Interior Marshland (fig. 83)
  - 242.31 Rush Series*
  - 242.32 Bur-reed Series*
  - 242.33 Cattail Series*
  - 242.34 Bulrush Series*
- 242.4 Rocky Mountain Montane Marshland
  - 242.41 Rush Series*
- 242.5 Great Basin Interior Marshland
  - 242.51 Rush Series*
  - 242.52 Saltgrass Series*
- 242.6 Sierran—Cascade Montane Marshland
  - 242.61 Rush Series*
- 242.7 Pacific Coastal (Oregonian) Interior Marshland
  - 242.71 Rush Series*
- 242.8 Pacific Coastal (Oregonian) Maritime Marshland
  - 242.81 Saltgrass Series*
  - 242.82 Glasswort Series*

243 Warm Temperate Marshlands
- 243.1 Southeastern Interior Marshland
  - 243.11 Cattail Series*
- 243.2 Southeastern Maritime Marshland (fig. 84)
  - 243.21 Saltmarshgrass Series*
- 243.3 Chihuahuan Interior Marshland
  - 243.31 Saltgrass Series*
- 243.4 Mohavian Interior Marshland
  - 243.41 Rush Series*
  - 243.42 Saltgrass Series*
- 243.5 Madrean Marshland
  - 243.51 Rush Series*
- 243.6 Californian Interior Marshland
  - 243.61 Cattail Series*
- 243.7 Californian Maritime Marshland
  - 243.71 Cordgrass Series*
  - 243.72 Glasswort Series*

244 Tropical—Subtropical Marshland
- 244.1 Caribbean Interior Marshland
  - 244.11 Cattail Series*
  - 244.12 Giant Reed Series*
  - 244.13 Sawgrass Series*
- 244.2 Caribbean Maritime Marshland
  - 244.21 Saltgrass Series*
- 244.3 Tamaulipan Interior Marshland
  - 244.31 Cattail Series*
  - 244.32 Giant Reed Series*
- 244.4 Gulf Coast Maritime Marshland
  - 244.41 Saltgrass Series*
- 244.5 Sinaloan Interior Marshland
  - 244.51 Cattail Series*
- 244.6 Sinaloan Maritime Marshland
  - 244.61 Glasswort Series*
- 244.7 Sonoran Interior Marshland (fig. 85)
  - 244.71 Cattail Series*
  - 244.72 Giant Reed Series*
  - 244.73 Bulrush Series*
  - 244.74 Threesquare Series*
- 244.8 Sonoran Maritime Marshland
  - 244.81 Saltgrass Series*
  - 244.82 Glasswort Series*

250 Strand Formation

251 Arctic—Boreal Strands
- 251.1 Polar Maritime Strand***
- 251.2 Greenlandian Strand***
- 251.3 Alaskan Maritime Strand***
- 251.4 Canadian Interior (Stream and Lake) Strand***
- 251.5 Canadian Maritime Strand***
- 251.6 Adirondack—Appalachian Alpine and Subalpine Stream and Lake Strand***
- 251.7 Rocky Mountain Alpine and Subalpine Stream and Lake Strand***
- 251.8 Sierran—Cascade Alpine and Subalpine Stream and Lake Strand***

***Our incomplete knowledge of these biotic communities precludes presentation of representative fifth (series) level examples.*

Table 5.—Continued

252 Cold Temperate Strands
- 252.1 Northeastern Interior (Stream and Lake) Strand***
- 252.2 Northeastern Maritime Strand
  - 252.21 Sandreed Series*
- 252.3 Plains Interior (Stream and Lake) Strand
  - 252.31 Annual Series*
- 252.4 Rocky Mountain Montane Stream and Lake Strand
  - 252.41 Annual Series*
- 252.5 Great Basin Interior Strand
  - 252.51 Annual Series*
- 252.6 Sierran—Cascade Interior Strand
  - 252.61 Annual Series*
- 252.7 Pacific Coastal (Oregonian) Interior Strand***
- 252.8 Pacific Coastal (Oregonian) Maritime Strand (fig. 86)
  - 252.81 Sandreed Series*

253 Warm Temperate Strands
- 253.1 Southeastern Interior Strand***
- 253.2 Southeastern Maritime Strand*** (fig. 87)
- 253.3 Chihuahuan Interior Strand
  - 253.31 Annual Series*
- 253.4 Mohavian Interior Strand
  - 253.41 Annual Series*
  - 253.42 Mixed Scrub Series*
- 253.5 Madrean Stream and Lake Strand
  - 253.51 Annual Series*
- 253.6 Californian Interior Strand
  - 253.61 Annual Series*
- 253.7 Californian Maritime Strand
  - 253.71 Mixed Scrub Series*
  - 253.72 Sea-grass Series*
  - 253.73 Green Algae Series*
  - 253.74 Brown Algae Series*
  - 253.75 Red Algae Series*

254 Tropical—Subtropical Strands
- 254.1 Caribbean Interior Strand***
- 254.2 Caribbean Maritime Strand***
- 254.3 Tamaulipan Interior Strand***
- 254.4 Gulf Coast (Tamaulipan) Maritime Strand***
- 254.5 Sinaloan Interior Strand
  - 254.51 Annual Series*
- 254.6 Sinaloan Maritime Strand
  - 254.61 Mixed Scrub Series*
- 254.7 Sonoran Interior Strand (fig. 88)
  - 254.71 Mixed Scrub Series*
  - 254.72 Annual Series*
- 254.8 Sonoran Maritime Strand (fig. 89)
  - 254.81 Mixed Scrub Series*

260 Submergent Vegetation

261 Arctic—Boreal Submergents
- 261.1 Polar Marine Submergents
  - 261.11 Phytoplankton Series*
- 261.2 Greenlandian Inland Submergents
  - 261.21 Phytoplankton Series*
- 261.3 Alaskan Marine Submergents
  - 261.31 Phytoplankton Series*
- 261.4 Canadian Inland Submergents
  - 261.41 Phytoplankton Series*
- 261.5 Canadian Marine Submergents
  - 261.51 Phytoplankton Series*
- 261.6 Adirondack—Appalachian Alpine and Subalpine Submergents
  - 261.61 Phytoplankton Series*
- 261.7 Rocky Mountain Alpine and Subalpine Submergents
  - 261.71 Phytoplankton Series*
  - 261.72 Pondweed Series*
- 261.8 Sierran—Cascade Alpine and Subalpine Submergents (fig. 90)
  - 261.81 Phytoplankton Series*
  - 261.82 Pondweed Series*

262 Cold Temperate Submergents
- 262.1 Northeastern Inland Submergents
  - 262.11 Pondweed Series*
- 262.2 Northeastern Marine Submergents
  - 262.21 Ruppia Series*
  - 262.22 Eelgrass Series*
- 262.3 Plains Inland Submergents
  - 262.31 Pondweed Series*
- 262.4 Rocky Mountain Montane Submergents
  - 262.41 Pondweed Series*
- 262.5 Great Basin Inland Submergents
  - 262.51 Pondweed Series*
- 262.6 Sierran—Cascade Montane Submergents
  - 262.61 Pondweed Series*
- 262.7 Pacific Coastal (Oregonian) Inland Submergents
  - 262.71 Pondweed Series*
- 262.8 Pacific Coastal (Oregonian) Marine Submergents
  - 262.81 Ruppia Series*
  - 262.82 Eelgrass Series*
  - 262.83 Brown Kelp Series*

263 Warm Temperate Submergents
- 263.1 Southeastern Inland Submergents
  - 263.11 Pondweed Series*
- 263.2 Southeastern Marine Submergents
  - 263.21 Ruppia Series*
- 263.3 Chihuahuan Inland Submergents
  - 263.31 Pondweed Series*
- 263.4 Mohavian Inland Submergents
  - 263.41 Pondweed Series*
- 263.5 Madrean Inland Submergents
  - 263.51 Pondweed Series*
- 263.6 Californian Inland Submergents
  - 263.61 Pondweed Series*
  - 263.62 Milfoil Series*
- 263.7 Californian Marine Submergents
  - 263.71 Ruppia Series*
  - 263.72 Eelgrass Series*
  - 263.73 Giant Kelp Series*
  - 263.74 Feather-boa Kelp Series*
  - 263.75 Southern Sea Palm Series*

264 Tropical—Subtropical Submergents
- 264.1 Caribbean Inland Submergents
  - 264.11 Pondweed Series*
- 264.2 Caribbean Marine Submergents
  - 264.21 Green Algae Series*
- 264.3 Tamaulipan Inland Submergents
  - 264.31 Pondweed Series*
- 264.4 Gulf Coastal Marine Submergents
  - 264.41 Ruppia Series*
- 264.5 Sinaloan Inland Submergents
  - 264.51 Pondweed Series*
- 264.6 Sinaloan Marine Submergents
  - 264.61 Phytoplankton Series*
- 264.7 Sonoran Inland Submergents
  - 264.71 Pondweed Series*
  - 264.72 Milfoil Series*
- 264.8 Sonoran Marine Submergents
  - 264.81 Ruppia Series*
  - 264.82 Eelgrass Series*

FIGURES

Figure 1.—Tundra Formation (5,110.) Alpine zone of Mt. Kilimanjaro in equatorial Africa.
(Photo by G. Burrows)

Figure 2.—Forest Subformation (1,120.) Mature sitka spruce and hemlock forest on Admiralty Island, Alaska. (USDA Forest Service photo 396402)

Figure 3.—Woodland Subformation (3,120.) *Nothofagus* woodland in Patagonia, South America. (Time-Life photo)

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Figure 10.—Strand Formation (1,250.)

Figure 11.—Submergents (1,260.) Kelp beds and sea otters off west coast of North America. (Sierra Club photo)

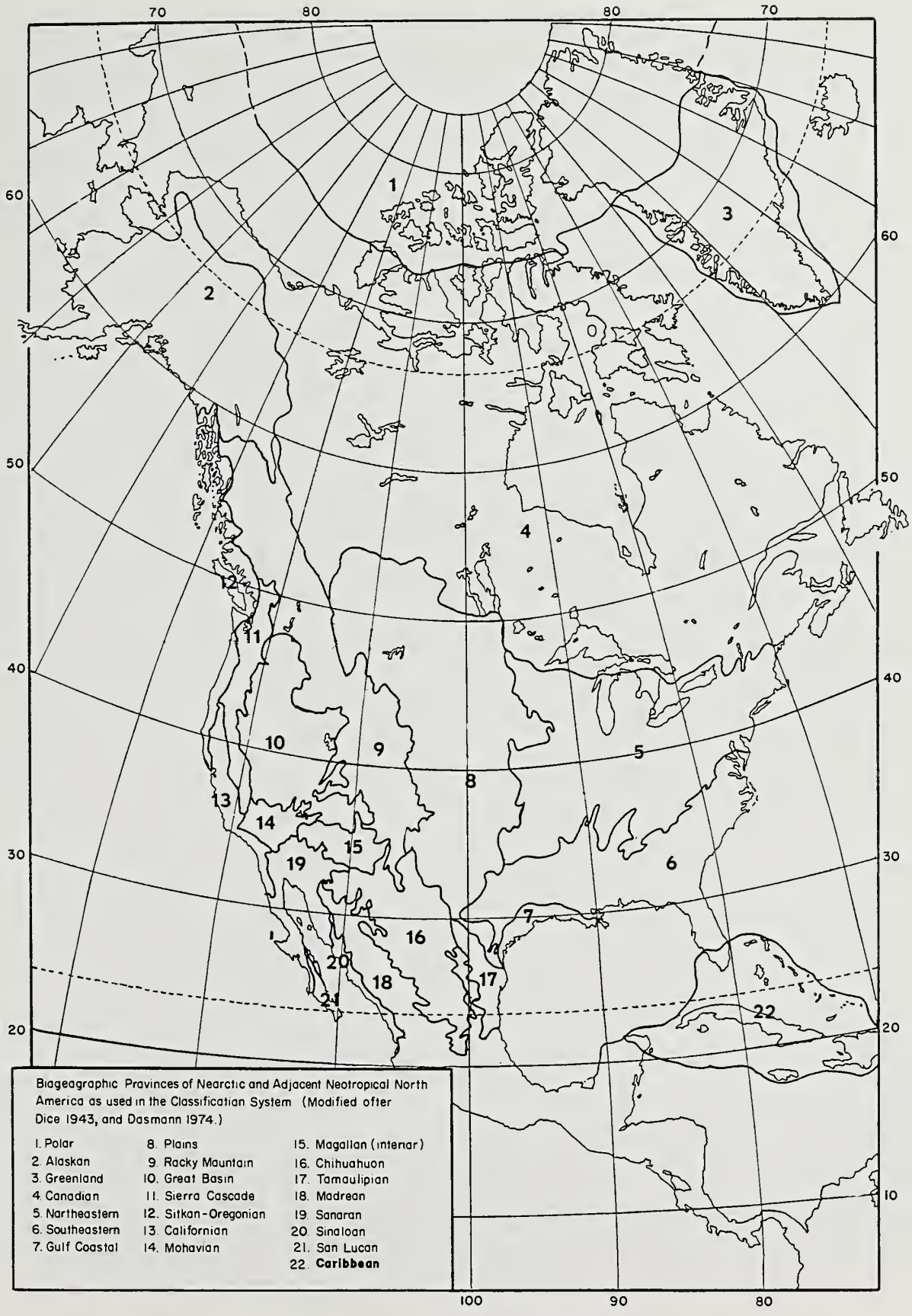

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Figure 32.—Relict conifer forest (123.5). A postclimax community of Arizona cypress at 1,760 m on north-facing slope on Coronado National Forest, Arizona. Such forests are restricted to north-facing slopes and draws at mid-elevations from sub-Mogollon encinal woodlands and interior chaparral in Arizona southeastward to Nuevo Leon, Mexico.

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Figure 40.—Alaskan alpine scrub (131.3). Aniakchak Crater, Alaska. (USDI National Park Service photo)

Figure 41.—Rocky Mountain alpine scrub (131.5). Shrub willows dominate this site in San Juan National Forest, Colorado.

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Figure 43.—Plains deciduous scrub (132.3). Mottes of midget or shinnery oak (*Quercus havardii*) on dunes near the New Mexico-Texas border. (USDA Soil Conservation Service photo)

Figure 44.—Californian chaparral (133.1). Los Padres National Forest, California.

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Figure 46.—Interior chaparral (133.3). Sierra Ancha Experimental Forest, Arizona.

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Figure 58.—Caribbean savanna grassland (144.1). Caribbean National Forest, Villalba, Puerto Rico. (USDA Forest Service photo 449364)

Figure 59.—Gulf coastal grassland (144.2) near Henrietta, Tex. (USDA Soil Conservation Service photo)

Figure 60.—Sonoran savanna grassland (144.3) near Benjamin Hill, Sonora.
(Photo by R.E. Tomlinson)

Figure 61.—Polar desert–scrub (151.1). The desertland aspect of certain tundra communities is shown here within a Rocky Mountain alpine tundra formation. Arapaho National Forest, Colorado. (USDA Forest Service photo 449580)

Figure 62.—Great Basin desert-scrub (152.1). Shadscale—winterfat community on the Desert Experimental Range, Utah. (USDA Forest Service photo 468710)

Figure 63.—Mohave desert-scrub (153.1). *Yucca—Larrea tridentata* association in Clark County, Nevada.

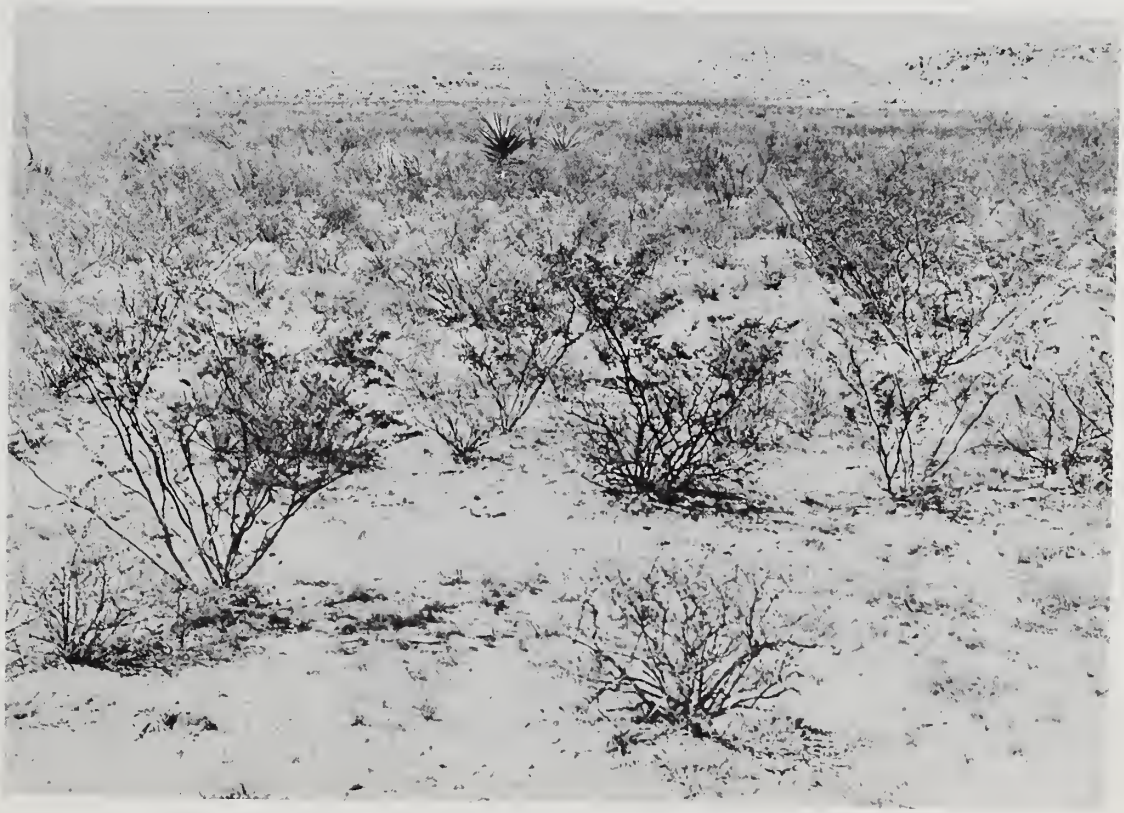

Figure 64.—Chihuahuan desert-scrub (153.2). *Larrea—Flourensia* association near Sanderson, Tex.

Figure 65.—Sonoran desert-scrub (154.1). Central Gulf Coast community near Libertad, Sonora.

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Figure 68.—Northeastern riparian forest (222.1). A cottonwood—maple community along the Des Moines River in Iowa. (USDA Forest Service photo 437131)

Figure 69.—Southeastern swamp-forest (223.1) in North Carolina dominated by bald cypress (*Taxodium distichum*). (USDA Forest Service photo (395087)

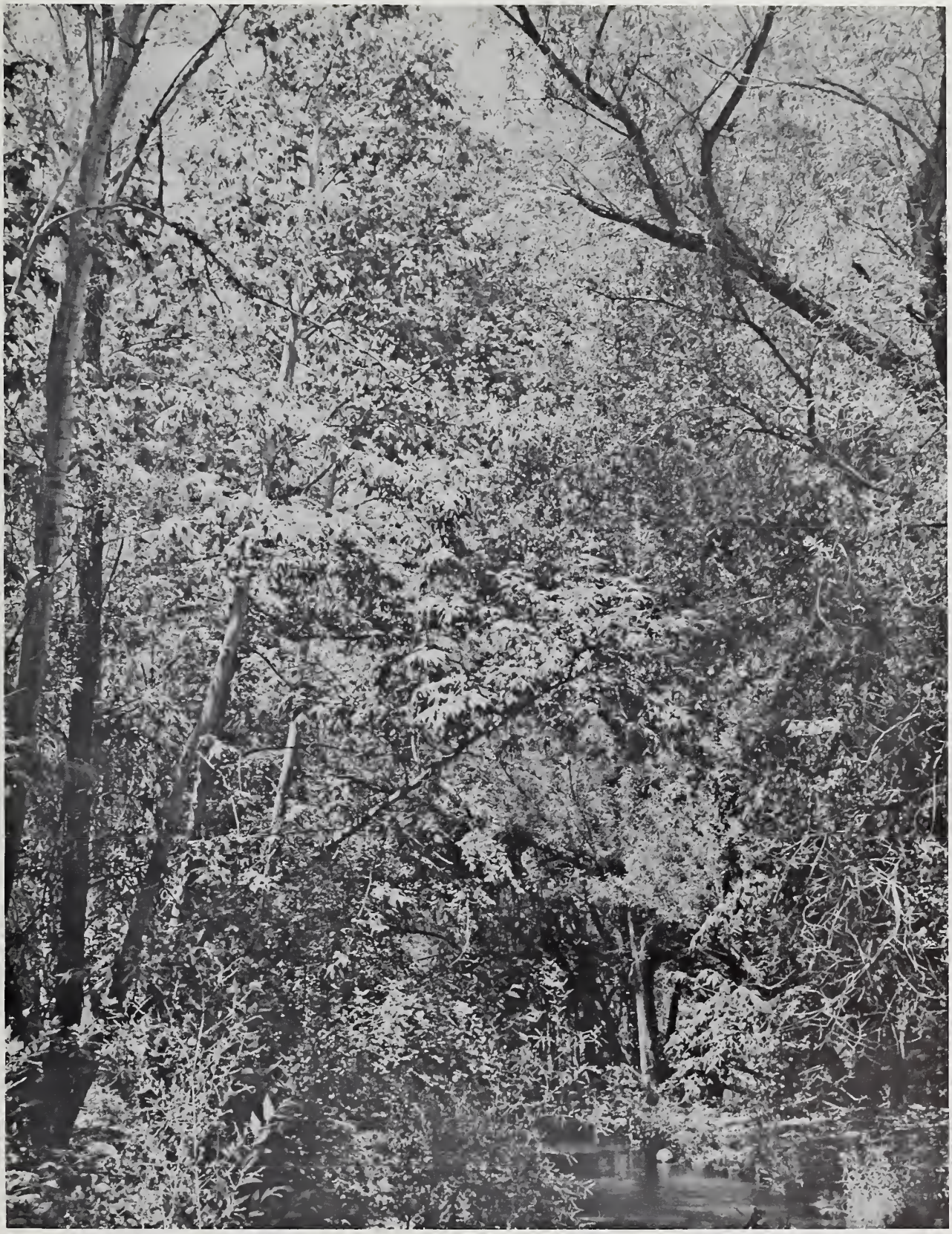

Figure 70.—Southwestern riparian deciduous forest and woodland (223.2). Mixed broadleaf community along Beaver Creek in the Coconino National Forest, Arizona.

Figure 71.—Caribbean maritime swamp-forest (224.2) of mangrove *(Rhizophora mangle)* in the Virgin Islands. (USDA Forest Service photo 518630)

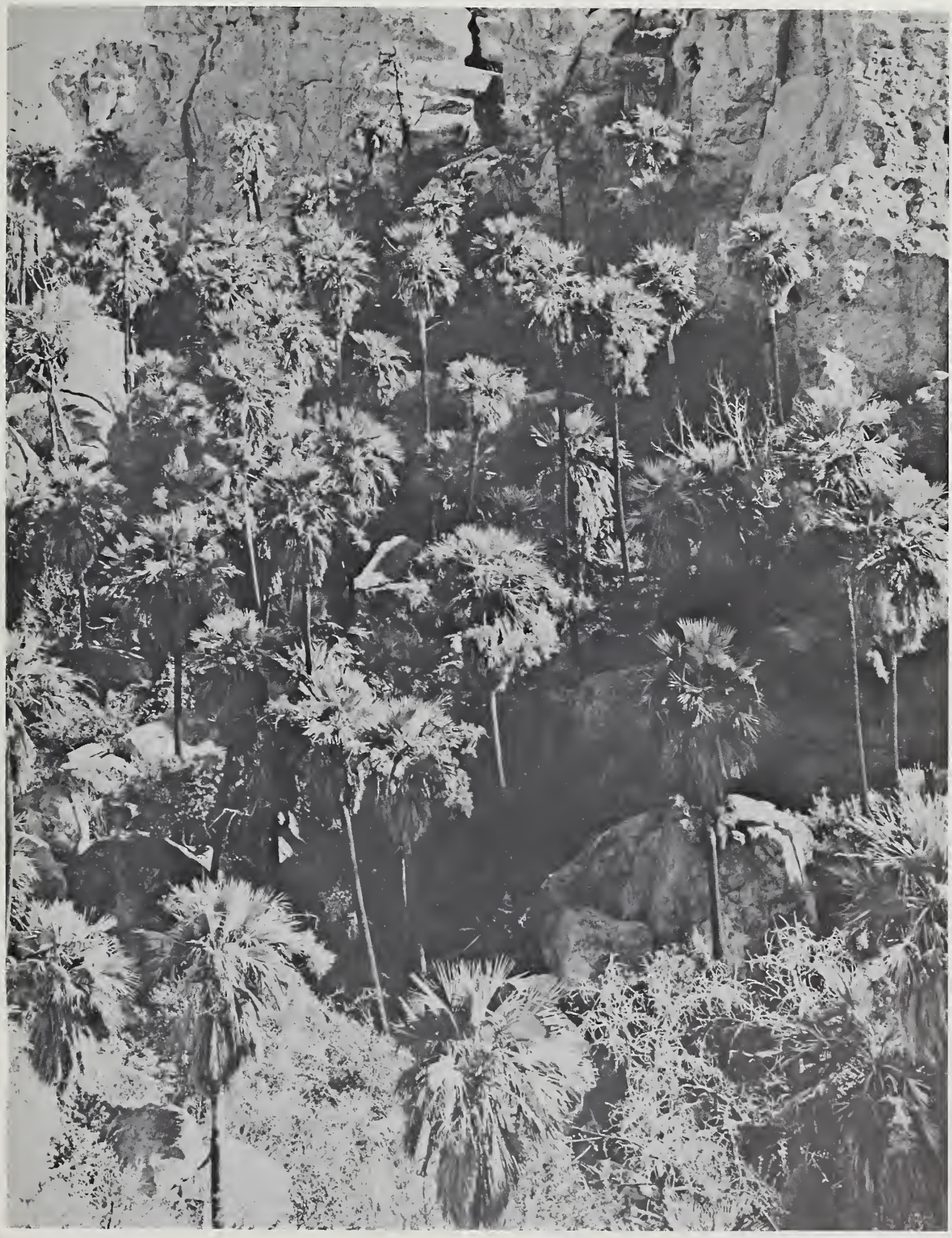

Figure 72.—Sinaloan riparian evergreen forest (224.4). A forest of Mexican blue palms (*Sabal uresana*) growing mostly in a box canyon in the Sierra Babiso, Sonora.

Figure 73.—Sonoran oasis forest (224.51). A linear community of California fan palms (*Washingtonia filifera*) within the Sonoran Desert in Arizona growing along a narrow spring-fed drainage.

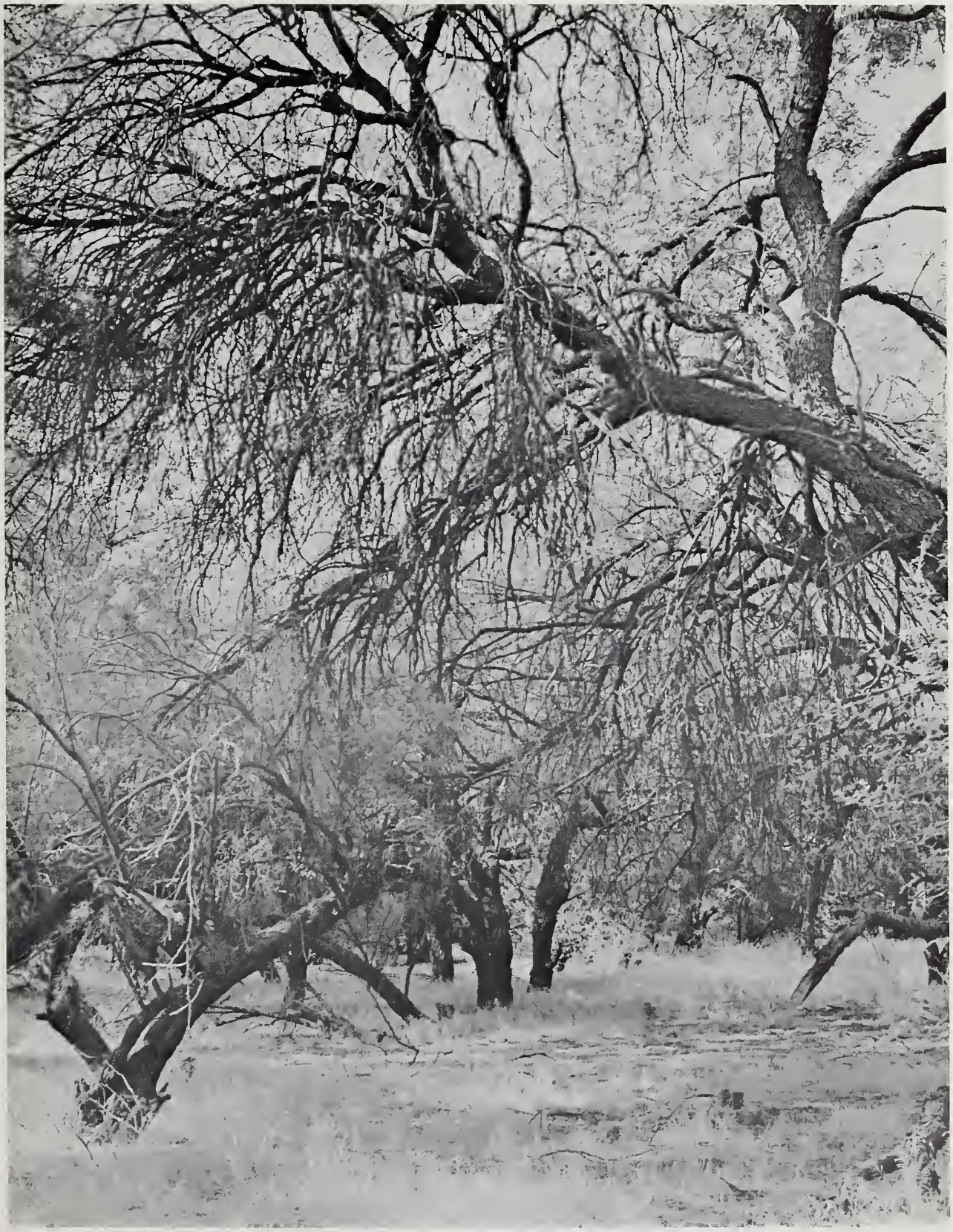

Figure 74.—Sonoran riparian deciduous woodland (224.52). A mesquite "bosque" community along the Verde River in Arizona.

Figure 75.—Canadian bog swamp–scrub (231.4). Leatherleaf (*Chamaedaphne calyculata*) community in Massachusetts. The forest in background is composed of black spruce (*Picea mariana*), tamarack (*Larix laricina*), and red maple (*Acer rubrum*). (USDI Fish and Wildlife Service photo)

Figure 76.—Rocky Mountain alpine riparian scrub within tundra (231.6). Shrub willows dominate these drainages in the Arapaho National Forest, Colorado. (USDA Forest Service photo 449579)

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Figure 84.—Southeastern maritime (intertidal) marshland (243.2) at mouth of Satilla River, Georgia. (USDI Fish and Wildlife Service photo)

Figure 85.—Sonoran interior marshland (244.7) of giant reed (*Phragmites communis*) along Colorado River in Arizona. (Photo by R.L. Todd)

Figure 86.—Pacific coastal (Oregonian) (intertidal) strand (252.8) near Port Angeles, Wash.
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Figure 87.—Southeastern maritime (intertidal) strand (253.2), Assateague Island, Virginia.
(USDI National Park Service photo)

Figure 88.—Sonoran interior strand (254.7). Desert wash within the Sonoran Desert in Arizona. Periodically scoured, these "desert" environments are nonetheless true wetland environments.

Figure 89.—Sonoran maritime strand (254.8) near Cruz Piedra, Sonora.

Figure 90.—Sierran—Cascade alpine submergent vegetation (261.8) in the form of phytoplankton is the only vegetation in this glacial pool—home of the golden trout. (USDI National Park Service photo)

Brown, David E., Charles H. Lowe, and Charles P. Pase. 1980. A digitized systematic classification for ecosystems with an illustrated summary of the natural vegetation of North America. USDA Forest Service General Technical Report RM-73, 93 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

An increasing need for careful husbandry of the earth's natural resources has renewed interest in the classification and mapping of ecosystems. The inventory of our remaining biotic entities is particularly urgent because the increased aspirations of a constantly growing world population are placing ever greater stress on these generous, but finite, living resources.

Keywords: digitized system classification, North American vegetation, ecosystems

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Rocky Mountains

Southwest

Great Plains

U.S. Department of Agriculture
Forest Service

Rocky Mountain Forest and Range Experiment Station

The Rocky Mountain Station is one of eight regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

RESEARCH FOCUS

Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

RESEARCH LOCATIONS

Research Work Units of the Rocky Mountain Station are operated in cooperation with universities in the following cities:

Albuquerque, New Mexico
Bottineau, North Dakota
Flagstaff, Arizona
Fort Collins, Colorado*
Laramie, Wyoming
Lincoln, Nebraska
Lubbock, Texas
Rapid City, South Dakota
Tempe, Arizona

*Station Headquarters: 240 W. Prospect St., Fort Collins, CO 80526